DATA PROCESSING DIGEST

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Management Decision-making Techniques

O. R.—NEW AID TO MAKING BUSINESS DECISIONS

Peter Spooner
BUSINESS, April 1957; pages 69-73.

From the pages of the British journal BUSINESS comes one of the most down-to-earth and clear-headed explanations DPD has yet seen on operational (Brit.) research. American business men who have (rightly) refused to plow through esoteric treatises on OR will find it worth the time and trouble to seek out the full text of this article. Here are a few quotes to give a feel of the author's style and knowledge of his subject:

"O. R. is simply a management tool. Like any other tool it has to be used intelligently. Applying the findings of an O. R. investigation requires as much policy-making ability as applying the findings of research into product-design or manufacturing techniques."

"O. R. can thrive only under an 'enlightened' management. This means that it is almost invariably used by firms which have already adopted 'progressive' techniques like management accounting and statistical quality control. Its effect will be to make good firms better. The others should at least be interested in finding out what they are up against!"

"...Operational research....is ...simply a case of applying orthodox research principles in a new field.... The standard approach is 1) to study the problem; 2) to collect as much information as possible; and 3) to examine the information to see whether it reveals a 'cause and effect' pattern.

"When the investigator believes that he can 'explain' the problem he reproduces the actual situation in the form of a 'scientific model.' This is usually expressed in mathematical terms."

"After he has constructed a mathematical model, the investigator usually tests it by collecting and examining more information.

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When the validity of his 'explanation' is established, the model can be used for either of two purposes:

> To judge the efficiency with which the operation is being carried out at present.
>
> To predict the consequences of carrying it out in a different way."

"An O. R. investigation has to make allowances for all variations: the aim is to establish a pattern of behaviour which will enable the results of certain actions to be predicted with a reasonable degree of accuracy.

Conventional picture of business is a static one

"Business situations are very seldom static. Yet the conventional methods of management control are continually trying to produce static pictures of them: the annual accounts are an obvious example. This is why operational research represents a new approach. It reproduces a continuously-changing situation in the form of a 'dynamic' picture which can be projected into the future, without any of the 'ifs' implied in (say) a chairman's annual statement or a manufacturing schedule devised by orthodox means."

"The O. R. investigator does not work in a narrow corridor. He draws both inspiration and techniques from all scientific fields.... His recommendations are couched (or should be) in the language of executives, but the methods by which he has arrived at them are generally complex. And management has to take them on trust.

Management should "trust" OR people as it "trusts" its legal and financial counsel

"This, however, is hardly a revolutionary idea. The business man has plenty of experience of taking on trust the information provided by specialists in various fields--accountants, legal experts, tax advisers and laboratory research workers. His confidence in them, and his willingness to use them, increase as the value of their advice or their predictions is borne out in practice."

"Operational research can be applied to virtually any activity which justifies the expense of a thorough investigation and provides sufficient information for a 'cause and effect' pattern to be established."

"... There is no reason to suppose that O. R. will be restricted to very large companies. Before long, it may be brought within the reach of all firms whose operations would be regarded as sufficiently complex to justify the expense of a full-scale investigation by ordinary management consultants."

Examples of the use of operations (Amer.) research techniques are given, along with a brief description of the techniques commonly used, such as linear programing, Monte Carlo, and simulation.

CAR CONTROL BY COMPUTER

RESEARCH FOR INDUSTRY (Stanford Research Institute) May 1957.

Every day the Southern Pacific Railroad must govern the movement of more than 10,000 empty general-purpose boxcars. Moreover, it must pay $2.75 per day for every car on its lines that belongs to another railroad. It behooves the railroad to distribute these cars to best possible advantage. To do so it must supply the Central Car Distribution Office with up-to-date and complete information. Factors to be considered in car movement are: operating condition of each car; location and direction of movement at the moment of need; seasonal variations, weather, crop conditions; railroad's gateways and interchange points; physical condition of cars in relation to the goods available for loading.

Operations research analysis of R.R. operation

Three years ago the Southern Pacific and Stanford Research Institute began a study of the car-distribution problem, resulting in a new car-intelligence system based on a mathematical "model" of the car-distribution system developed by operations research techniques. Data processing by punch-card equipment and data reduction and projection by electronic computer are part of the process.

"On the basis of the test operations, it seems certain that the new system will effect a significant reduction in the number of empty boxcars required by the railroad's operations. At the same time it will increase the line's ability to give shippers good service."

The first step was "an operations research analysis of the pertinent aspects of railroad operation.... sources of empty boxcars, their movements and related time requirements, and their physical classifications.... The types, sources, and flow were carefully studied from existing records and reports."

Empty car distribution by mathematical model

Resulting from this study was the "formulation of a mathematical 'model' of the Southern Pacific car distribution system. This model permits analysis of the reported data on a given week's operations. The result is a forecast of the car holdings and movements required to meet the following week's empty boxcar needs."

Between 70,000 and 100,000 cards reflecting data from the railroad's standard operating reports, are processed every day.

"The summary information is reprocessed in the computer, using the forecasting formula, to provide a preliminary prediction of empty boxcar needs for the ensuing week."

Two sets of information are provided: 1) "How many empties of each grade should be moved between each pair of operating divisions on the line to provide the most efficient flow of empty cars"; and 2) "the best future schedule for ordering empties from connecting railroads."

SCIENTIFIC INVENTORY CONTROL

by W. Evert Welch
Published by Management Publishing Corp., 1956

This rather unusual book will be of interest to those members of management who want to learn of improved inventory control procedures without requiring much mathematics on their part. All the reader need remember about his math is algebra and even that can be fairly rusty. And yet the concepts presented are of a reasonably sophisticated nature.

Rules for ordering keep down inventory costs

The author analyzes the questions "how much to order" and "when to order." Under "how much," he develops simple rules (formulas) relating order quantity, number of orders per year, and average inventory on hand with the annual dollar usage for each part. Thus this method ties in well with the so-called ABC inventory control system. The actions of the rules are clearly shown by graphs. The objective of the rules is to minimize total overall inventory cost, and examples illustrate how the principles work.

Additional complexities such as certain parts having a higher ordering cost, variable unit costs or quantity discounts, and variable usage are considered. Methods of preparing nomographs to aid in manual decision making using these techniques is explained.

Under the "when to order" question, the author analyzes the effect of variations in lead time, variations in usage, and frequency of reordering on the reorder point problem. Simple safety stock rules and formulas are developed.

The final chapter presents the steps which can be followed in introducing these techniques in a practical case. The reader gets the impression that the author has participated in a number of such studies himself; his approach sounds practical.

Only one minor criticism might be in order. A somewhat mechanical approach is presented, which can lead to trouble if the analyst does not have a good understanding of the basic factors in his particular case--annual usage, variations in usage, and so on. The author does point out the need for this understanding but perhaps not firmly enough; a sizeable percentage of the readers may miss this crucial point. On the whole, though, he has done a commendable job within his original scope and objective.

Price: $12.50.

General Information

FACTS CONCERNING INITIAL PLANNING AND ORGANIZATION OF SPAN ELECTRONIC PROCESSING CENTER

LaSPAN, May 1957 (Published by Los Angeles Chapter, SPA)

Cooperative EDP

Four insurance companies in Hartford, Connecticut (whose combined names form the acronym SPAN) have formed a cooperative data processing center to serve its members in such needs as recording and accounting, calculating reserves, furnishing underwriting results, and management reports. The SPAN organization will also maintain and keep up to date all machine procedures used jointly, organize all new applications, and continue research into electronic processing for the benefit of the SPAN companies. The four companies (which it is hoped will be increased in number later on) are Springfield Insurance Companies, Phoenix of Hartford Insurance Companies, Aetna Insurance Group, and National of Hartford Group. The entire staff of SPAN will be drawn from these companies. It is hoped the data processing center will begin operation by 1958. All planning has been done cooperatively, and a cooperative plan for training programers has been set up. The organization will install an IBM 705. LaSPAN (the similarity in name is a coincidence) carries the entire text of the news release from the SPAN information center. Copies or source information may be obtained from LaSPAN editor: Ross P. Moore, Autonetics, 9150 E. Imperial Hwy., Downey, Calif., or from Ragnar E. Anderson, SPAN Electronic Processing Center, 670 Main Street, Hartford 15, Connecticut.

APPLICATION OF DATA-PROCESSING EQUIPMENT IN THE OFFICE—SOME INTERNAL AUDIT IMPLICATIONS

E. C. R. Williams and D. J. Bailey, Electronic Computer Service of Unilever, Ltd.
THE INTERNAL AUDITOR, June 1957; pages 17-27.

This article, reprinted from The Accountant, November 3, 1956, presents some of the areas of concern to internal auditors in an electronic data processing system.

It is suggested that the internal auditor should be included in the planning and programing stages to see that adequate checks are programed into the system. He should carefully supervise the preparation of input data and all routines for entering data into the system. He should provide, where possible, for control totals prepared outside the machine, or for machine-calculated totals prepared independently

of the programed system. He should examine the machine output and the operations log for possible evidence of manual interference and unauthorized manipulation. He could make a practice of surprise checks, either by checking the log book or by ordering special programed checks. He can control possible falsification of records through careful division of duties in the data processing organization.

AUTOMATIC SEARCH OF LIBRARY DOCUMENTS

S. Richard Moyer, University of Pennsylvania
COMPUTERS AND AUTOMATION, May 1957; pages 24-29.

A description is given of a method of indexing documents for automatic retreival on an IBM 705. The system was designed by personnel of the Institute for Cooperative Research of the University of Pennsylvania. The system includes a new operation, indexing by the use of descriptors, which takes the place of extensive cataloging. Initial acceptance of documents would consist of the typing of 17 bibliographical facts and an average of 30 descriptors on a special assembly of electric typewriters (some of which would be remotely controlled) and simultaneous card-punching equipment to produce in one operation all the necessary control records, including the necessary input to the computer. The document record would be kept on magnetic tapes, each 2500 ft. reel holding 14,000 document records. These records could be searched by the computer at the rate of 150,000 documents per hour. Results would be printed out in the form of a list of identifying and locating numbers for the documents containing the desired information.

Magnetic records of document identification

The Institute has estimated that such a system, staffed by the necessary crew, could do a literature search of a document collection in approximately two percent of the man-hours required by a completely human staff. The cost would be approximately 18.9% of the cost of a human staff, and the results would be more accurate, thorough and complete. In addition, such a system would allow for a higher number of descriptors and bibliographical facts per document.

PROFITABLE AUTOMATION FOR SMALL AS WELL AS LARGE BANKS

Everett J. Livesey, Chairman, Committee on Savings Management and Operations, American Bankers Association
UNITED STATES INVESTOR, April 27, 1957; pages 35-39, 42.

A progress report is given on the status of electronic banking equipment, both for large banks and for the smaller ones which have felt they were unable to consider such equipment. Mr. Livesey suggests that groups of banks having a total of 200,000 or more accounts could profit from a joint data processing system.

The merits and disadvantages of both "on-line" and "off-line" systems are discussed, and systems now operating, about to operate, and in design stages are described.

ORAL TIMEKEEPING PLAN REPLACES CLOCK PUNCHING

AMERICAN BUSINESS, May 1957; page 42.

NEW LOOK IN TIMEKEEPING

FACTORY MANAGEMENT AND MAINTENANCE, June 1957; page 139.

In the General Electric plant in Detroit, call boxes connected with a key-punch room have eliminated both the time clock and the timekeeper. When a worker comes to his work station, when he starts or finishes a job, he calls in his number and the appropriate job information. This is immediately key-punched into a tab card by the operator receiving the call. These cards are integrated with the master tabulating card which contains prepunched rates and job information, comprising a "package" which goes to the machine accounting unit. The company reveals that the system has released 11 workers for other duties and provides a faster flow of information to accounting and management concerning the real situation in the plant at any time. The system has already paid for itself three times over, and is making an annual saving of about $36, 000.

THE FUNCTIONS OF I.D.P.

K. G. Belbeck, Stevenson & Kellogg, Ltd.
OFFICE EQUIPMENT NEWS, May 1957; pages 26, 27, 52, 54.

The objectives of improving data processing are to lower costs, to process data faster, and to provide more accurate information. The organizational implications of IDP ((used here in its broad systems engineering sense)) are: a tendency toward the centralization of data processing, compatibility with either a centralized or decentralized management, possible formation of new functional groups, and a concept of IDP which is company-wide rather than departmental.

It follows that "any company considering entering I. D. P. must be resigned to a complete and exhaustive program of systems study and design.... It is in this study and redesign stage that most companies experience a big and immediate financial pay-off."

"Above all, a sound program requires the interested support of top management. There may come a time in the program when top management will have to exercise authority to overcome deep-seated objections against integrating across divisional or departmental lines."

ELECTRONIC DATA PROCESSING COMES TO TIME STUDY

Joseph Motycka and Travers Auburn, Pratt & Whitney Aircraft
JOURNAL OF INDUSTRIAL ENGINEERING, Jan.-Feb., 1957; pages 11-18.

The Industrial Engineering Department of Pratt and Whitney has applied the use of an electronic computer for the determination of time standards, to speed up the production of the Time Study Analyst. In the system, the analyst examines the blueprint and methods sheet for a part, to determine the elements to be allowed. This information is key punched into cards, is verified, and is then fed to the computer. The computer has all standard data stored in memory, and computes the time standard for the part from the input information.

By-product advantages include the calculation of standards for different lot sizes, to take setup and preparation into account. Also, time standards for inspection are calculated for cases of 100% inspection and for cases of sampling.

The details of preparing the data for input to the computer are presented.

ELECTRONIC COMPUTERS—PRINCIPLES AND APPLICATIONS

Edited by T. E. Ivall
Published by Philosophical Library, 1956

For those who cannot be content until they know what actually goes on inside a computer, this book will be of interest and help. It covers the engineering and technical aspects of both digital and analog computers.

From an EDP standpoint, the chapters on digital computers will be of the most interest. These chapters include: basic arithmetic circuits, control circuits, general organization, storage systems, digital computer equipment and applications of digital computers.

The text, while directed primarily toward technical people, is written in fairly simple language and is thus suitable for many who do not have a technical background. It has been written by technically competent authors. The book has 11 chapters, 167 pages, and uses numerous drawings and photographs to illustrate the text.
Price: $10.00

PROMISES VERSUS PERFORMANCES IN ELECTRONIC DATA PROCESSING EQUIPMENT

Milton Woll, Retail Research Institute, NRDGA
STORES, April 1957; pages 46-50.

A survey of NRDGA stores showed that "the great majority of stores still process their data manually and are apparently unimpressed by the claims made for punched card data processing." Moreover, most stores feel that electronic data processing has been oversold by the manufacturers, and that careful step-by-step solving of problems is to be preferred to sweeping systems re-deisgn. Requirements for electronic equipment are given these priorities: 1. large storage capacity, 2. rapid input devices, 3. speed of output, 4. random referral.

ELECTRONICS: INVESTIGATE BEFORE YOU INVEST

DeFord C. Mills, Albert Kushner; Cresap, McCormick and Paget
STORES, May 1957; pages 17-19, 22.

Somewhat in contrast to the views of Mr. Woll (see above) is this plan for investigating electronics in the retail operation. Although manufacturers are blamed for much of the foot-dragging among retailers, the authors feel that the retailers have failed to educate themselves on the possibilities and the realities of EDP. Four basic considerations are suggested and discussed as a basis for EDP planning: 1) the need for individual study, 2) the need for an integrated systems approach to the problems, 3) the desirability of full utilization of selected equipment, and 4) the extent of existing mechanization.

RECOMMENDED PLACEMENT FOR THE COMMON MACHINE LANGUAGE ON CHECKS

BANKING, May 1957; pages 48, 49, 154, 156, 159.

A forthcoming booklet issued by the Bank Management Commission of the American Bankers Association will present the Commission's recommendations for placement of common language medium on checks, a problem which the Commission has been working on for several years. Still remaining for solution are the type of information to be coded, location of each part of the information, and the number of digits needed. Consideration is also being given to simplifying the combined A. B. A. transit number-routing symbol. Specifications for the type font for the common language are being established by the machine equipment manufacturers.

Pre-qualified check specifications

The recommendations for placement of the common language on the checks are as follows:

Parallel and adjacent to the bottom edge of all checks.

For all checks, except 80-column punch card checks, both pre-printing and post-printing should be confined in a band 1/4" wide, located 1/4" from the bottom edge.

On 80-column punch card checks, pre-printed characters should be placed below the 9's punched hole position. Post-printed information for these checks would be at the same location designated for all other types of checks.

"Placing post-printed characters on punch card checks in the same position as paper checks will eliminate a requirement for separate post-printing devices (or a device with an adjustable printing position) for paper versus punch card checks."

Analysis of statistics on card column usage showed that there are ample columns available on most punch card checks to accomodate all necessary punching without having to use the area designated for the post-printing.

Systems Engineering

RELIABILITY IN BUSINESS AUTOMATIC DATA PROCESSING

Herbert T. Glanz, John Diebold & Assoc., New York
COMPUTERS AND AUTOMATION, May 1957; pages 20-23, 42.

"...As automatic systems exercise a greater amount of control and direction, one must place a correspondingly greater emphasis on their operating reliability....Many systems engineers become so enamored of possible accomplishments that they tend to overlook the question of system reliability and the implications of component failure." Especially in "real-time" ((or on-line)) systems, the factor of reliability is important, and in fact, is the "greatest single functional difference" between on-line and batch processing systems.

Anticipate failures in the design stage

The author's organization designs real-time systems with the assumption that all components of a system are liable to failure, but that over-all operations must not fail. A large stock brokerage and a medium-size transportation company are referred to in showing the steps taken in designing the system to insure continuous

performance. First, only proved components are used. Second, continual preventive maintenance of all equipment is required. Third, a provision is made for human intervention in the event of a complete system failure. "At present, an intelligent human being is the surest substitute and the safest means of providing against the varying and complex difficulties that can arise. Accordingly, it is necessary to provide the mechanical system with a capable and trained operating staff.... We have found it wise to run periodic 'alerts' in which a variety of failures are simulated and the proper counter-measures are promptly initiated."

AN APPROACH TO THE STUDY OF ELECTRONIC DATA-PROCESSING PROBLEMS

A. H. Dawkes, Royal Ordnance Factories, Ministry of Supply (England)
O. & M. BULLETIN, April 1957; pages 78-85.

"The approach to computer problems is...fundamentally different from that required when installing the conventional type of accounting machine...." The steps suggested for installing an electronic system are: Break down the present system into a flow diagram, observing these rules: 1) at each step there must be an input which is either new data or output from a previous step; 2) each "test" situation where a decision determines the next course of action can have only one of two possible solutions; 3) all inputs must result in outputs at either intermediate or final operations. Now observe where the present system does not meet the requirements of the flow chart principles. Next, consider the storage needs of the system, including the length of records, and the advisability of combining fragmented or duplicated records into one master record. Third, consider the manipulation of data needed to produce the desired results, and the form the results should take (output). Finally, draw a flow chart of the new system.

INDEXING FOR RANDOM ACCESS MEMORY SYSTEMS

DATA PROCESSOR, April 1957

If it is impossible to number parts or other reference information to be stored in a computer memory to coincide with the addresses of the memory system, another numbering or indexing method must be devised. Frequently part numbers of catalog numbers include letters along with the digits. Such numbers must be subjected to mathematical processes called "randomizing." This article gives a very simple example of this process, using catalog numbers which are a mixture of digits and letters. In this system, the final four digits of the catalog number are used as the address.

Equipment

"TYPATAPE": A NEW DATA PROCESSING MEDIUM

Glenn E. Hagen, Typatape, Inc., New York
AUTOMATIC CONTROL, January 1957; pages 50-53.

The automatic recording of original information in a form which can automatically reproduce that information is a basic principle of integrated data processing, and has been the stumbling block all too frequently in the design of an efficient system. One of the drawbacks to most data recording equipment is that it is expensive, and since there are many data origination stations in any one system, the recording equipment frequently overbalances the system in terms of quantity of equipment and expense.

The Typatape was developed with these drawbacks in mind. It is inexpensive, and it is a simple electrical or mechanical device. It can be attached mechanically to a manually-operated typewriter or adding machine, a cash register, or a number of other data-producing machines which operate on similar principles.

Mechanical link: printed coded tape to punched media

The Typatape system uses a paper tape on which an entire block of digits can be printed at one stroke in a positionally-coded form. Since an entire entry can be printed at one time, there is no need for a buffer to hold information and feed it into the printer serially, as with other types of recording devises. The paper tape is 1/4-inch wide, and is printed by means of an ordinary smudgeproof carbon ribbon.

The coded digits are impressed through the carbon onto the paper tape by recording racks moving at right angles to the tape. When a group of notched racks, representing the 10 to 16 digits which form a block, are in place, the tape is pressed against the racks and the carbon ribbon, thus printing the pattern which will be read by a photoelectric reader. This reader may be connected to IBM or Remington Rand card punches for automatic conversion to punched cards, or to either punched tape or magnetic tape recorders. No parity check is needed in this system. Should a poor impression or smudged or misaligned character appear, the photoelectric reader would sound an alarm, stopping the mechanism. The author sees interesting possibilities for using this simple and inexpensive device in such data-producing situations as utilities meter reading, gasoline pumps, time clocks, and weighing devices.

(See also DPD: Dec. 1956 page 12 and Jan. 1957 page 15.)

FOSDIC II—READS MICROFILMED PUNCHED CARDS

TECHNICAL NEWS BULLETIN (National Bureau of Standards), May 1957

FOSDIC II is an improved FOSDIC I which will be used by the Weather Records Center in Asheville, N. C., to aid in processing weather data contained on over 300 million punched cards. The cards are microfilmed on 100-ft. 16-mm rolls, each roll containing up to 13,000 images of punched cards. An anamorphic lens on the camera reduces the short dimension of the punch card to 1/2 normal size, making the punched holes appear as squares on the film. Nearly twice as many cards may thus be recorded on the film. As the film passes by FOSDIC's scanning head, the image is read and results stored in the memory of 120 bits. At the end of a scan, the memory contents are compared with the plugboard pattern, and if there is agreement, the film is stopped at the proper image. As FOSDIC rescans the entire image, a card is punched to reproduce the card image. Then the scanning process proceeds to look for the next match. At the present time the equipment is limited to searching a 10-column field, with searching rate at 4000 cards per minute.

PHILCO TRANSAC MODEL S-2000

The Philco TRANSAC S-2000 is an all-transistor computer designed for scientific and business applications. It has a 4,096-word magnetic core memory which may be expanded to a capacity of 65,536 words. Program instructions are chosen with automatic programing and compiler routines in mind. The computer is built on the module principle, so that additional input and output units may be added without difficulty.

Programing

DIGITAL COMPUTER PROGRAMING

D. D. McCracken
Published by John Wiley & Sons, Inc., 1957

At long last has appeared a scholarly, competent book on the subject of programing for general purpose digital computers. Although the general purpose computer field is over ten years old, and though programing has been fundamental to the use of these machines, there

has been no generally available source of published information on the subject. The only other effort of this type DPD has come across is the home study course "Programming for Business Computers," an excellent correspondence course which concentrates on business applications. (See DPD, August 1956; page 16.)

Practical text on programing principles and techniques

Both of these have devised a fictitious computer to enable the student to follow practical examples and illustrations. Since programing is a symbolic representation of logical thinking, a "paper" computer can fill the bill as well as a "real" one, for purposes such as a book.

"Digital Computer Programming" chooses to use a computer called TYDAC (Typical Digital Automatic Computer). All examples and all problems are centered around this computer which is described in great detail in both the text and the appendix, where the reader finds a complete list of TYDAC's order code for reference. The computer is a sort of composite of all the well-known computers now on the market. Thus, the reader who is seriously interested in understanding programing procedures and techniques will have little trouble transferring his knowledge from the TYDAC to whatever medium or large scale computer he may have to work with.

Terms are defined at the outset. Simple examples demonstrate the logic of what the author is saying in the early chapters. The reader is led into more advanced aspects of programing in a gradual manner. Many of the more advanced illustrative examples are based on engineering problems in line with the author's background and experience. But the fundamentals are there, and it would behoove the ambitious business-careerist to absorb what he can. It is important to add that, while the examples lean toward the scientific, the general language of the book is not in "scientific" jargon, but rather in a lucid, interesting and simple conversational style. This, and the excellent description of the characteristics and operation of TYDAC, are the book's biggest assets.

Scientific examples, but basic enough for all types

The book should be well-suited for text book use; exercises are presented at the end of the chapters. Here are some of the subjects discussed: numbering systems, the use of loops, flow charting (an excellent chapter), floating decimal, checking (worth reading by anyone who is using computers), relative and interpretive programing, magnetic tape programing. The appendix contains the computer code mentioned above, minimum access programing, number conversion tables, and a brief but excellent bibliography. 253 pages, 18 chapters. Price: $7.75.

Comment

THE COST OF INACTIVE STORAGE

One factor often overlooked in discussions of random-access memories is the cost of inactive storage. It is this factor, to a large extent, that makes random-access systems so expensive compared with magnetic tape systems; and therefore makes random-access difficult to justify unless the need for rapidly available, immediately up-to-date information is most urgent.

Random access storage is too costly for any but urgent use

In a magnetic tape system the cost of having data available to the central processor and ready to use is about 1/100 ¢ per character per month. This is the cost of the tape mounted on a tape drive mechanism. But the cost of inactive storage, that is, the reel of tape by itself is about 1/30, 000 ¢ per character per month. On the other hand, in a random-access system all the data is always ready to use and is stored at a cost of about 1/50 ¢ per character per month in presently available disc or tape-strip random-access systems. (For comparison, the cost of inactive storage on punched cards is about 1/20, 000 ¢ per character per month.)

Suppose a business has mechanized files of 100, 000, 000 characters (this is probably on the low side in an integrated EDP system). At any one time about 5, 000, 000 will be in process. Thus the storage costs in a tape system would be:

$$5,000,000 \times \frac{1}{100} + 95,000,000 \times \frac{1}{30,000} = \$532. \text{ per month (approx.)}$$

In a completely random access system the storage cost would be

$$100,000,000 \times \frac{1}{50} = \$20,000 \text{ per month}$$

a high price for the completely random system.

Thus it appears that until a major design breakthrough is made in random-access systems, magnetic tape processing will be a vital part of any EDP system. Random access will be reserved for those files for which the rapid access to any record is absolutely vital, and therefore economically justified.

INTEGRATED DATA PROCESSING

New film produced by N.O.M.A.

A new 35-minute color film, "Integrated Data Processing," has been produced by the National Office Management Association. As with most films on this vast subject, in its limited time it can only skim the surface. The film consists of many close shots of paper-tape-producing and -utilizing equipment being used for sales order processing (through to the invoicing and shipping operations), production orders (including material requisitioning), and point-of-sale data processing via cash register input.

The system design function needs more graphic presentation

The narrator explains how the principles of integrated data processing (i.e., the perpetuation of the information from its first input on paper tape) apply to the business functions being performed by the equipment. The eye sees the tape being punched, the tab cards being prepared, the tape-operated typewriters operating without human hands. At the same time the ear hears the systems concepts being described. Since sight is the dominant sense, the viewer would understand the narrator's message more clearly if he could <u>see</u>, through animation or charts, the flow of information and a comparison of the simplified operation with the old manual methods. The viewer's involuntary preoccupation with the mechanical and electronic marvels of the machines keeps him from concentrating on his more basic need for an understanding of the system being described.

A series of do's and don'ts presented verbally by the narrator at the end of the film loses another opportunity for visual clarity.

Therefore, for best use, the film should be preceded with a thorough introduction to concepts of information flow and systems design by a competent instructor, using other visual aids. The film can then be of value in showing the physical aspects of the systems concepts, and the actual handling of equipment and materials to put the systems into operation.

The film may be purchased for $400. For information, write to Field Services Division, National Office Management Association, Willow Grove, Pennsylvania.

References

The addresses of publishers and periodicals mentioned in this issue of Data Processing Digest are listed below for your convenience in obtaining further information about the articles or books listed.

American Business
4660 Ravenswood
Chicago 40, Illinois

Automatic Control
430 Park Avenue
New York 22, New York

Banking
12 East 36th Street
New York 16, New York

Business
Mercury House
109-119 Waterloo Road
London S.E. 1, England

Computers and Automation
815 Washington Street
Newtonville 60, Massachusetts

Data Processor
IBM Corporation
590 Madison Avenue
New York 22, New York

Factory Management and Maintenance
330 West 42nd Street
New York 36, New York

Internal Auditor
120 Wall Street
New York 5, New York

Journal of Industrial Engineering
225 North Avenue, N. W.
Atlanta, Georgia

Management Publishing Corporation
22 West Putnam Avenue
Greenwich, Connecticut

Office Equipment News
146 Bates Road
Montreal 8, Canada

O. & M. Bulletin
Treasury Chambers
Great George Street
London S. W. 1, England

Philosophical Library, Inc.
15 East 40th Street
New York 16, New York

Research for Industry
Stanford Research Institute
Menlo Park, California

Stores
100 West 31st Street
New York 1, New York

Technical News Bulletin
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DATA PROCESSING DIGEST is published each month by Canning, Sisson and Associates, 1140 South Robertson Boulevard, Los Angeles 35, California. Subscription rate: $24.00 per year. Foreign postage (exclusive of Canada and Mexico): $2.00 additional. Single copies: $3.00 when available. Editor: Margaret Milligan

Training

Electronic Data Processing for Business and Industry (sponsored by Canning, Sisson and Associates)

Date: July 22-26, 1957
Place: New York City (Hotel Roosevelt)
Fee: $160
Program: Emphasis on the applications aspect of electronic data processing
For whom: Controllers, Methods and Procedures Supervisors, others in management charged with setting up an EDP system
Information: Canning, Sisson and Associates, 1140 South Robertson Blvd., Los Angeles 35, Calif.

Summer Session, 1957, University of Michigan--"Intensive Courses for Men in Engineering, Science, and Business"

Date: August 19-30
Place: University of Michigan, Ann Arboe, Michigan

Courses in the Computer and Management Sciences:
- Introduction to Digital Computer Engineering
- Advanced Digital Computer Engineering and Logical Design
- Introduction to the Electronic Digital Computer and Its Applications
- Applications of Advanced Numerical Analysis to Digital Computer Problems
- Applications of Logic to Advanced Digital Computer Programing
- Management Sciences

Fee: For each of above courses only, $200
Registration and Information: Co-ordinator of Engineering Summer Conferences, 2038 East Engineering Building, Ann Arbor, Michigan

Computer Applications, special course following the "Computers and Data Processing" Symposium (see Meetings)

Date: September 3-13, 1957
Place: University of Denver, Denver Research Institute
Instructors: First week--W. B. Kennedy and J. A. Williams, Denver Research Institute Computer Laboratory
Second week--Dr. John W. Carr III, University of Michigan (President of ACM)
Enrollment: Enrollment may be made for either or both weeks
Fees: Total course--$45 plus $10 for text; first week only--$20; second week only--$25
Information: William B. Kennedy, Computer Laboratory Supervisor, Denver Research Institute, University Park, Denver 10, Colorado

Summer Program, Wayne State University Computation Laboratory

<u>Course and Date:</u> September 9-14, Industrial and Management Computer Applications

<u>Information:</u> A. W. Jacobson, Director, Computation Laboratory, Wayne State University, Detroit 2, Michigan

Operations Research, Special Program for Graduate Scientists and Engineers in Industry

<u>Date:</u> September 16, 1957 to January 24, 1958

<u>Place:</u> Case Institute of Technology

<u>Prerequisites:</u> Degree in Science or Engineering, knowledge of Mathematics through Differential Equations, knowledge of Introductory Statistics or Probability

<u>Credit:</u> Graduate credit for students able to satisfy Case's Graduate School entrance requirements

<u>Fee:</u> $1000

<u>Information and Registration:</u> Dr. Russell L. Ackoff, Director, Operations Research Group, Case Institute of Technology, 10900 Euclid Avenue, Cleveland 6, Ohio

Master's Program in Automatic Data Processing, Wayne State University (School of Business Administration and the Computation Laboratory)

<u>Information:</u> Walter Folley, Dean, School of Business Administration, or A. W. Jacobson, Director, Computation Laboratory, Wayne State University, Detroit 2, Michigan

Meetings

WESCON--Western Electronic Convention

<u>Date:</u> August 20-23, 1957

<u>Place:</u> San Francisco, California

<u>Information:</u> WESCON, 342 North La Brea, Los Angeles 36, California

Computers and Data Processing, 4th Annual Symposium sponsored by University of Denver

<u>Date:</u> August 29, 30, 1957

<u>Place:</u> Denver Research Institute (University of Denver)

<u>Information:</u> J. Marshall Cavenah, Electronics Division, Denver Research Institute, University of Denver, Denver 10, Colorado

International Conference on Operational Research, sponsored by Operational Research Society, Operations Research Society of America, The Institute of Management Sciences

Date: September 2-6, 1957
Place: University of Oxford, England
Subjects: The common themes in operational research, methodology, applications

Conference on Matrix Computations

Date: September 3-6, 1957
Place: Department of Mathematics, Wayne State University
Information: Professor Wallace Givens, Chairman, Department of Mathematics, Wayne State University, Detroit 2, Michigan

Instrument Society of America, 12th Annual Instrument Conference

Date: September 9-13, 1957
Place: Cleveland, Ohio
Information: Herbert S. Kindler, Director of Technical Programs, Instrument Society of America, 313 Sixth Avenue, Pittsburgh, Pennsylvania

Third Electronics Business Systems Conference sponsored by the Western Division of National Machine Accountants Association

Date: November 7, 8, 1957
Place: San Diego, Calif. (U.S. Grant Hotel)
Information: G. M. Blakesley, Third Electronic Business Systems Conference, P. O. Box 1448, San Diego 12, California

Eastern Joint Computer Conference--"Computers with Deadlines to Meet"

Date: December 9-12
Place: Washington, D. C. (Sheraton Park Hotel)
Information: Malcolm B. Catlin, Council for Economic and Industry Research, Inc. Arlington 2, Virginia